July 2004

AFM Tapping Mode Instructional Guide

STEP 1: LOG IN TO THE AFM LOG BOOK

"NOTE: this guide does not take the place of reading the manual"

Figure 1
AFM Stage & Head assembly

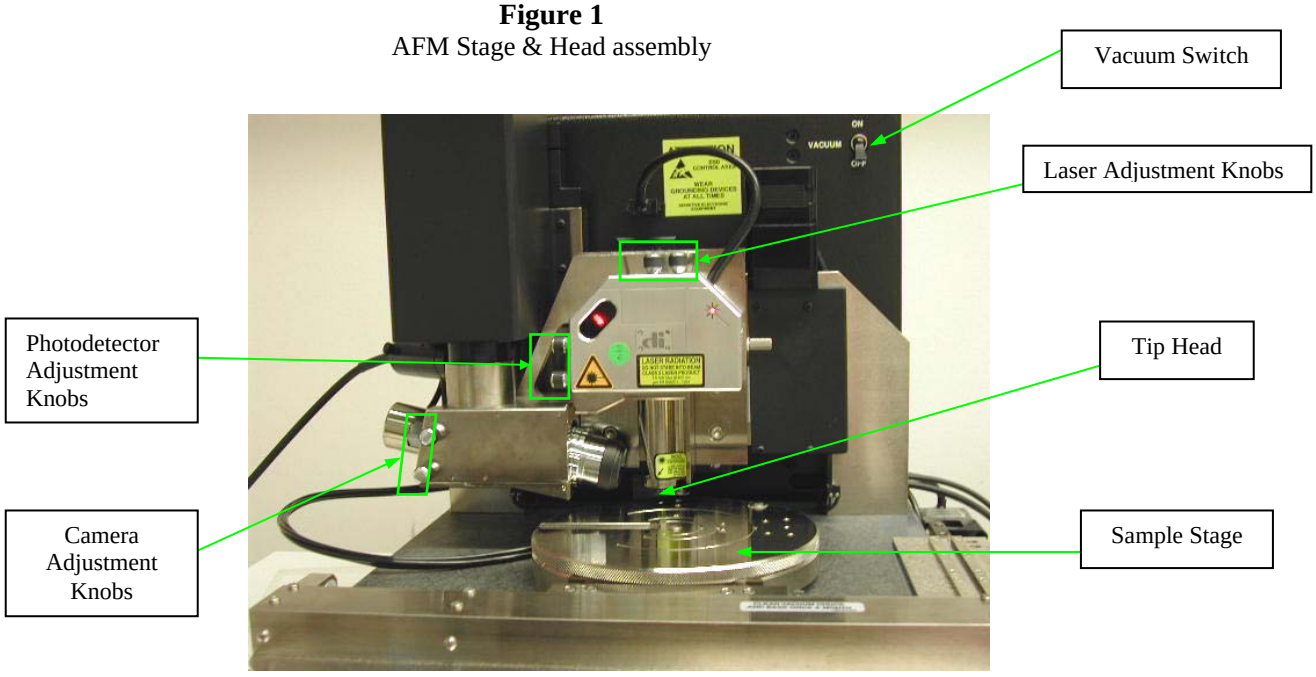
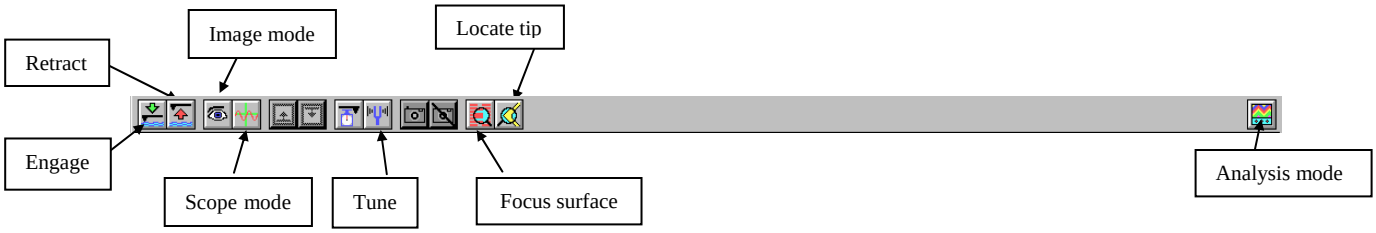


Figure 2
Software Toolbar

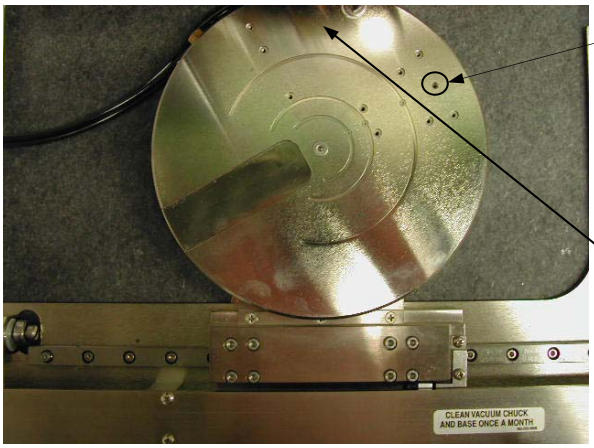


Part 1: Start-up

1. Turn on the system by switching on the power strip behind the monitors.
2. When the log-in screen appears, just press OK. There is no password.
3. Open up the AFM software with the "Nanoscope SPM" shortcut icon on the desktop.
4. Click on the  (microscope) icon to go to the main display.
5. Make sure the microscope is in Tapping Mode by selecting 'Profile' from the 'Microscope' menu. If the Tapping Mode option isn't highlighted, please ask for assistance.

Part 2: Sample Positioning

1. The first thing you must do is make sure the vacuum switch is in the off position. Then follow the steps below to place your sample on the sample stage.



1. Place small samples here. For larger samples, please ask for assistance.

2. Manually rotate the sample stage until the sample is approximately here.

Figure 3
Stage

2. When you finish placing the sample on the sample stage, turn the vacuum switch back on, and click on the  icon (or select 'focus surface' from the 'stage' menu) and use the trackball (Figure 4) to move the sample until it reaches the small circle of green light beneath the tip head. Don't focus the surface yet.

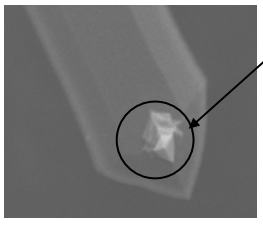
Use the trackball alone to move the stage

Hold down the focus button while moving the trackball to focus the surface.

Hold the lock button to keep the stage moving in the same direction without using the trackball

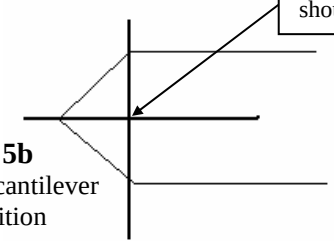
Figure 4
Trackball

3. Click on the  icon (or select 'locate tip' from the 'stage' menu) to locate the tip. Use the camera adjustment knobs to center the tip on the screen, and use the focus function on the trackball to focus the tip.



This is the tip

Figure 5a
SEM image of AFM tapping mode tip



This is where the tip should be centered

Figure 5b
Schematic of cantilever & tip position

4. Click on the (focus surface) icon once again and use the trackball to focus the sample underneath the tip and to locate the specific area you want to scan. Never use 'Autofocus'. It does not work correctly.

Part 3: Scanning

1. Before lowering the tip and starting a scan, you must tune the cantilever by clicking the (tune cantilever) icon. Click on the 'Autotune' button (upper left side of screen). When the computer is finished tuning the cantilever, the picture you see should look close to Figure 6. If it doesn't, ask for assistance. When you are done, press the 'Back to Image Mode' button.

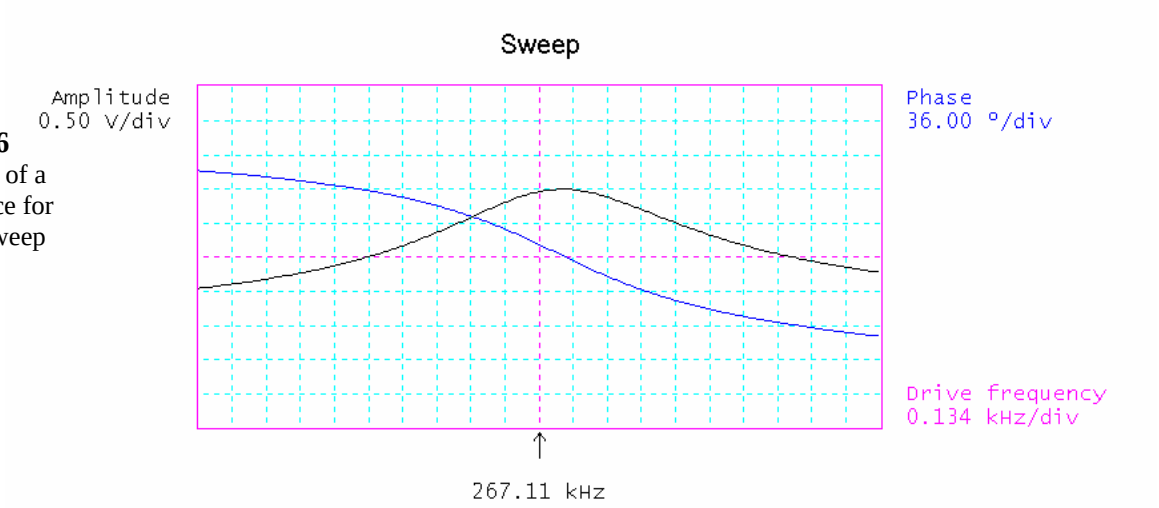


Figure 6
Example of a good trace for tuning sweep

2. Set the initial scan parameters. In the Scan Controls panel, set the scan size 1µm and scan rate to 1 Hz. In the Feedback Controls panel, set integral gain to 0.4 and proportional gain to 0.8. Also make sure offsets and scan angles are set on zero.

3. Lower the tip by pressing the (engage) icon. The computer will then automatically start a scan.

4. When the tip starts scanning, go to scope mode by pressing the (scope) icon. To get a valid image with AFM, the 'trace' and 'retrace' lines on the scanning mode graph must match up with each other. There are several parameters that can be changed to make this happen (see figures 7 and 8 below). To go back to image mode to view your scan, press the icon.

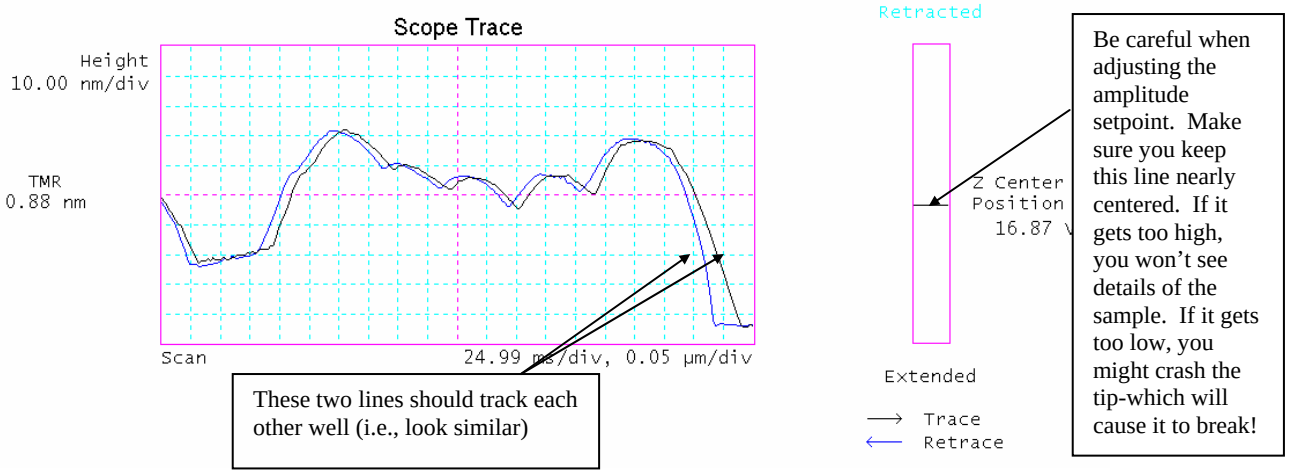
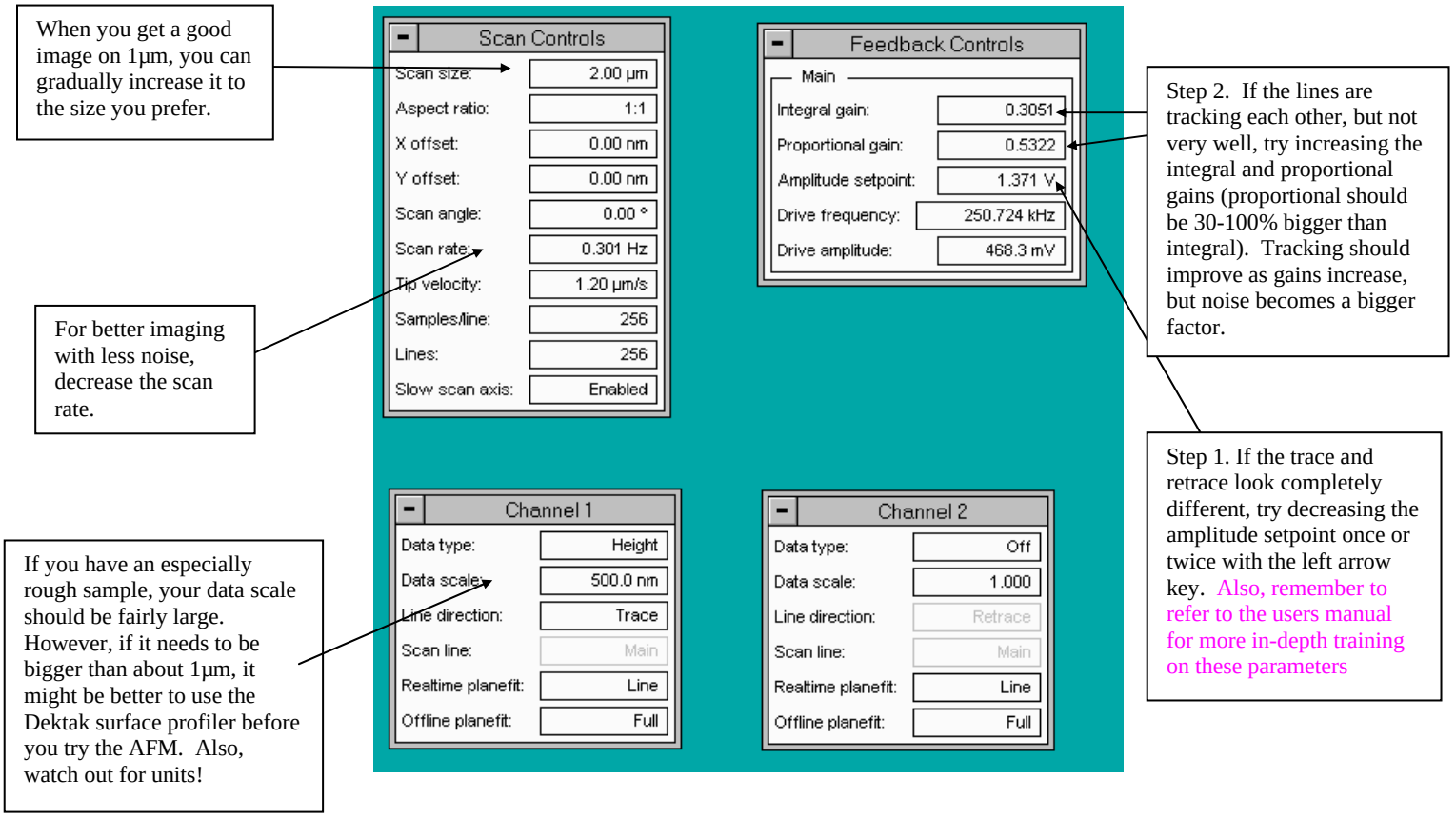


Figure 7

Figure 8
Tips for adjusting scan parameters



5. To capture an image, press either the (down) icon to restart a clean scan from the top, or the (up) icon to start it from the bottom. Then press the (camera) icon to start capturing an image. You'll notice that at the bottom of the left computer screen, the words 'Capture: On' will be displayed. When the computer finishes capturing, the words will say 'Capture: Done'. The captured image will automatically save. If you decide you don't want to capture, click the (cancel capture) icon. When the capture has finished, you can withdraw the tip by pressing the (retract) icon.

Part 4: Image Analysis

1. After you have captured the image and withdrawn the tip, you can view your saved image and do analysis by pressing the icon. This may take a couple of seconds. To name your file, go to File>Rename. If you want to export your file to a disk or another drive, go to Utilities>JPEG Export. Save the image in reverse colors and give it the name you want.

2. **For the full explanation of all of the functions in the AFM software, please see the users manual.** Here are a few things you can do with your Nanoscope Image file:
   a. If you want to see your image in 3D mode, press the icon
   b. If you want to see your image flat, press the icon
   c. To analyze roughness, press the icon.

There are many more functions listed in the 'Analyze' menu at the top of the screen. **For full descriptions, see the manual.**

3. If at any time you wish to save the current analysis of your image, go to Utilities> JPEG Export.

4. If you wish to print the current analysis screen, press the  icon.

Part 5: Shutdown

1. When you are finished analyzing your data and have saved all the files you want to keep, go back to the microscope mode by pressing the  in the top right corner. Then press the  (focus surface) icon and raise the head to back the tip away from the sample stage. Turn the vacuum off then rotate the sample stage and remove the sample. Make sure to remember to turn off the vacuum switch before attempting to remove the sample.

2. Exit out of the Nanoscope software by going to DI>Exit.

3. Shut down the computer using the Windows shutdown. When the computer says it is safe to turn of the computer, turn off the power strip in the back.

FINAL STEP: LOG OUT OF THE AFM LOGBOOK